

and estimates for the erection of the Sedgwick Memorial Museum of Geology on a site within the Old Botanic area, contiguous to the new Chemical Laboratory.

Dr. Forsyth, F.R.S., is appointed an additional member of the Mathematical Board for one year.

In consequence of the lamented death of Sir George E. Paget, Sir G. M. Humphry and Dr. D. MacAlister have been appointed to act for the Regius Professor of Physic, in reference to Acts for medical degrees during the vacancy in the professorship.

SOCIETIES AND ACADEMIES.

LONDON.

Mathematical Society, January 14.—Prof. Greenhill, F.R.S., President, in the chair.—The President drew the attention of the members present to the loss the Society had sustained by the recent death of Prof. Kronecker, who was elected an honorary member on January 14, 1875.—The following communications were made:—The harmonic functions for the elliptic cone, by E. W. Hobson. The harmonic functions for the circular cone were introduced by Mehler; an account of them is given in Heine's *Kugelfunctionen*. In this communication the more general functions are considered, which are required for potential problems connected with the elliptic cone. It is shown that the normal functions are of the form

$$\frac{1}{\sqrt{r}} \sin(\rho \log r) \cdot A(\mu) B(\nu),$$

where r is the radius-vector, and μ, ν are elliptic co-ordinates, the functions A, B satisfying differential equations which differ from Lamé's equation only in having $-\frac{1}{2} + \rho\sqrt{-1}$ instead of n ; thus the functions A and B are Lamé's functions of complex degree. The forms of these functions as required for the potential problem are considered, and some examples of their application are given.—Some theorems relating to a system of coaxial circles, by R. Lachlan. This paper is based on a suggestion contained in a short note by Dr. A. S. Hart in the *Quarterly Journal* (vol. ii. p. 143), who indicated a simple and elementary method of obtaining Poncelet's theorem. In the present paper this method is discussed in detail. Poncelet's theorem may be thus stated: *If $A_1, A_2, A_3, A_4, \dots, A_n$, be n points taken in order on the circumference of a circle S , so that any $(n-1)$ particular connectors of the polystigm $A_1A_2 \dots A_n$ touch fixed circles coaxial with S , then the remaining connectors of the figure will envelop circles which belong to the same coaxial system.* If now S_p, q denote the circle which is touched by the chord A_pA_q , it is proved that if $(n-1)$ connectors of the polystigm touch any $(n-1)$ of the circles $S_1, 2, S_1, 3, \dots, S_{n-1, n}$, the remaining connectors of the polystigm will envelop the remaining circles. A few special cases are then discussed, among which the most interesting is the case of $2n$ points $A_1, A_2, \dots, A_{2n}$, taken in order on a circle S , so that the chords $A_1A_2, A_2A_3, \dots, A_{2n}A_1$ touch another circle S' : it is then proved that the n chords $A_1A_{n+1}, A_2A_{n+2}, \dots, A_nA_{2n}$, must intersect in a limiting point of the circles S and S' , and that the remaining $2n(n-2)$ connectors may be divided into $(n-2)$ sets of $2n$, each set being tangents to a circle coaxial with S and S' . Further, it is proved that the $2n(n-1)$ connectors which do not intersect in the limiting point may be arranged in $n(n-1)$ pairs, each pair touching two circles of the system.—Note on the formula for the number of classes of binary quadratic forms of a given determinant, by Prof. G. B. Mathews.—Researches in the calculus of variations (third paper), by E. P. Culverwell.—Mr. E. B. Elliott, F.R.S., made a short oral communication on a generalization of De Morgan's method of duality in partial differential equations. He exhibited schemes of linear substitution for one set of variables in terms of another set of first derivatives, which have the self-dual property, discussing the cases of two and of three independent variables.—Major MacMahon, F.R.S., mentioned the "stamp-folding" problem, at which Prof. Schoute, of Groningen, has been working. For a strip of stamps (one stamp width), the following results, when the strip is folded so that the face (or back) of one stamp only is exposed, were given: (1) = 1, (2) = 2, (3) = 6, (4) = 16, (5) = 50, (6) = 144, (7) = 462, (8) = 1398 (?), (9) = 4527. For squares, the results given were (2) = 8, (3) = 296, (4) = 13007 (?). (9) is found to give more than $2\frac{1}{2}$ billions. The law of formation of the numbers is sought.—Messrs. Basset, Love, Kempe, Hobson, Prince C. de Polignac, and the President spoke upon the papers.

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Linnean Society, January 21.—Prof. Stewart, President, in the chair.—On a motion by the President, it was unanimously resolved that an expression of respectful sympathy should be conveyed to Her Majesty the Queen, and to H.R.H. the Prince of Wales, on the loss sustained by the death of H.R.H. the late Duke of Clarence and Avondale.—Mr. M. F. Woodward exhibited microscopic sections illustrating the development of the teeth in the Marsupialia. He drew attention to Prof. Kükenthal's recent discovery of supposed rudimentary successors in all the teeth, thus showing that the adult set of teeth must be regarded as belonging to the first or milk series, and not, as generally supposed, to the second or successional dentition. These statements he was able to confirm for the incisors and second upper molar of *Didelphys*. In the *Phalanger* (*Trichosaurus*) he found no trace of these structures in connection with the molar teeth, but they were present with the upper incisors. In no case did these rudimentary successional teeth pass beyond the condition of simple downgrowths from the enamel organs of the functional teeth.—Mr. J. W. Willis Bund exhibited a supposed hybrid between the common and red-legged partridges, but in the opinion of ornithologists present it was regarded as merely a variety of the former species.—Mr. J. C. Mansel Pleydell exhibited a pair of malformed horns of the roebuck found at Whatcombe, Blandford, Dorset, their peculiar growth resulting from exostosis consequent upon injuries sustained while in the sensitive condition.—Mr. D. Morris communicated some further notes upon the tick-pest of Jamaica, upon which an animated discussion took place.—A paper was then read by Mr. F. E. Weiss "on the development of the caoutchouc-containing cells of *Eucommia ulmoides*, Oliver." He found that the bark and leaves of this tree, used medicinally by the Chinese, and called by them "Tuchung," contain numerous elastic threads of silky appearance, which proved to be of the nature of caoutchouc. They are contained in long, unbranching cells, somewhat like latex cells, which are found in the cortex and in the secondary phloem, and accompany in large numbers the ramifying bundles of the leaf and the pericarp. Unlike the ordinary latex cells, they are not derived from specialised cells of the embryo, but originate in all new growths, and can be seen forming in the cortex, the pith, and the parenchyma surrounding the bundle of the petiole. They originate in twos, by longitudinal division of a very granular cell, both daughter cells growing out at their two extremities into a long tube, which makes its way along the intercellular spaces by sliding growth. They never contain more than one nucleus, and the large granules of caoutchouc, which soon make their appearance, finally coalesce into a single solid mass, which has, when the tissues are broken, the appearance of a silky thread. Mr. Weiss regards these cells as a primitive form of latex cells, similar to those from which the more elaborate ones of the ordinary *Euphorbiaceæ* may have been derived.—The meeting was brought to a close with a paper by Dr. Jean Müller on the Lichens of Manipur.

Royal Meteorological Society, January 27.—Annual General Meeting.—Dr. W. Marcet, F.R.S., Vice-President, in the chair.—The Report of the Council for the past year showed the Society to be in a very satisfactory position. In May the library and offices were removed to more commodious premises at 22 Great George Street. After defraying the cost of fitting up the new offices, and the increased rental, there still remained a balance in hand of £224. Thirty-four new Fellows were elected during the year, the total number on the roll of the Society now being 552. Owing to the absence of the President, Mr. Baldwin Latham, through an attack of influenza, his address on "Evaporation and Condensation" was read by the Secretary. The question of evaporation is of as great importance as the study of the precipitation of water on the face of the earth, as the available water supplies of the country entirely depend upon the differences between these two sets of observations. The earth receives moisture by means of rain, dew, hoar-frost, and by direct condensation. It loses its moisture very rapidly by evaporation. Although evaporation mainly depends upon the difference between the tensional force of vapour due to the temperature of the evaporating surface, and the tensional force of the vapour already in the atmosphere, yet it is largely influenced by the movement of the air and by its dryness, or the difference between the dew point and the actual air temperature. Evaporation goes on at night so long as the water surface is warmer than the dew point. With sea-water the evaporation is about $4\frac{1}{2}$ per cent. less than with rain water, while

with water saturated with common salt the evaporation is 15 per cent. less than with rain water. In his experiments Mr. Latham used an evaporating gauge made of copper, 1 foot in diameter, and containing 1 foot in depth of water, which was floated by means of a hollow copper ring placed 6 inches distant from the body of the evaporator, and attached to it by four radial arms. This form of evaporator was found extremely convenient in carrying on all evaporation experiments; it was floated in a tank 4 feet in diameter, containing 30 inches depth of water. During the period of thirteen years, from January 1879 to December 1891, this evaporator has never once been out of order, or been interfered with in the slightest degree by frost. Experiments were made with some 5-inch evaporators as to the effect of colour on the amount of evaporation, one being painted white, another black, and the results given by these gauges were compared with a copper gauge exposed under similar conditions. This comparison was the means of showing that the greatest errors in evaporating gauges arise from the capillarity of the water rising on the sides of the gauge, and thus inordinately increasing the amount of evaporation. Consequently a small gauge having a larger amount, in proportion, of side area than a larger gauge, gives a very much greater amount of evaporation. The results from the floating evaporator, 1 foot in diameter, show that the average amount of water evaporated annually during 1879-91 was 19.948 inches. It was found, however, that, as a rule, during the period from October to March, there were certain occasions when condensation was measured. The amount of these condensations in thirteen years averaged .308 inch per annum. The 5-inch evaporating gauge, freely exposed to atmospheric influences, gave during the same period (1879-91), an average annual depth of evaporation equal to 38.185 inches. The average annual evaporation, during the three years 1879-81, from the 5-inch copper gauge standing in water was 27.90 inches, from one painted black 22.97 inches, and from another painted white 21.74 inches, whilst a gauge of the same dimensions, freely exposed in the atmosphere, gave, in the same period, 36.96 inches, and the 1 foot floating evaporator, 19.40 inches. The 5-inch copper gauge gave a larger amount of evaporation than the gauge painted black.—Mr. Latham next described some percolation experiments which were carried out by Mr. C. Greaves at Old Ford, by Messrs. Dickinson and Evans at Hemel Hempstead, and by Sir J. B. Lawes and Dr. Gilbert at Rothamsted. He then detailed the results of his own experiments, and also the gaugings of the underground waters in the drainage areas of the rivers Wandle and Graveney. He further stated that in the course of his observations on the flow of underground water, he had observed that at certain particular seasons of the year it was possible to indicate the direction and volume of the flow of underground streams, even when they were at a considerable depth, owing to the formation of peculiar lines of fog.—Dr. C. Theodore Williams was elected President for the ensuing year.

PARIS.

Academy of Sciences, January 26.—M. Duchartre in the chair.—On the properties of the loxodromics of a cone of revolution, and their application to the conical spring, by M. H. Resal.—*Résumé* of solar observations made at the Royal Observatory of the Roman College during the last quarter of 1891, by Prof. Tacchini. Spots and faculae show a slight diminution when their frequency is compared with that of the preceding quarter. On no day, however, has the sun been observed free from spots.—Experimental study of the decimal equation in transit observations, made at Lyon Observatory, by MM. André and Gonnessiat.—On a real algebraical curve with constant torsion, by M. E. Fabry.—On the characteristic equation of water-vapour, by M. Ch. Antoine. The author shows that the weight, ω , of a cubic metre of water-vapour at a temperature t , and under a pressure H , is given by the relation

$$\omega = \frac{19.9H}{278 - 0.365\theta + t^2}$$

in which θ represents the temperature of the vapour at saturation under the pressure H .—Remarks on the subject of the experiments made by M. Gouy on the difference of potential produced by contact, by M. H. Pellat.—On Hertz oscillations, by M. A. Perot. In a recent work (*Wiedemann's Ann.*, xlv. pp. 74 and 92) Bjerknes shows that the oscillations of electro-motive force produced in a conducting wire by Hertz's method ought to be represented by the equation—

$$Y = Ae^{-a(t-\theta)} \sin \pi \left(\frac{t}{\tau} - \phi \right).$$

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M. Perot finds that the formula proposed is supported by experiments.—On aplatanism, by M. A. Broca.—The estimation of molybdenum, by M. E. Péchard. The compound containing the molybdenum is heated in a current of HCl, when $\text{MoO}_3 \cdot 2\text{HCl}$ volatilizes, is collected, dissolved in water, with the aid of nitric acid if any of the blue reduction compound is formed, and the solution evaporated to dryness; the molybdic acid is then weighed.—On the stereochemical constitution of diacetyl tartaric acid, by M. Albert Colson.—On some soluble colouring-matters produced by bacteria in medicinal distilled waters, by M. L. Viron.—On the existence of nitrification phenomena in media rich in acid organic substances, by M. E. Chuard.—Ammonia in rain-water and in the atmosphere, by M. A. Muntz.—In a former paper the author stated that the rain-water of tropical regions was richer in ammonia than that of temperate climates. This conclusion was combated by M. Lévy, who showed that the proportion of ammonia in rain caught at Montsouris was greater than that recorded by M. Muntz. The latter gentleman now points out that the observations made at Montsouris, or near any populous district, do not furnish proper criteria for the judgment of his first statement.—Earthworms and the bacilli of tuberculosis, by MM. Lortet and Despeignes.—On the inoculation of *dourine*, by M. Ed. Nocard.—Researches on the nervous system of Crustacea, by MM. F. Jolyet and H. Viallanes.—On the pelagic fauna of Dyrefjord (Iceland), by M. G. Pouchet.—On an elliptical halo observed around the moon on January 14, 1892; extract from a letter addressed to M. Cornu by M. Hamy.

BOOKS, PAMPHLETS, and SERIALS RECEIVED.

BOOKS.—*L'Évolution Sexuelle dans l'Espèce Humaine*: Dr. H. Sicard (Paris, J. B. Baillière).—*Les Problèmes de la Géologie et de la Paléontologie*: T. H. Huxley (Paris, J. B. Baillière).—*Report on the Scientific Results of the Voyage of H.M.S. Challenger*: Deep-Sea Deposits (Eyre and Spottiswoode).—*Treatise on Chemistry*, vol. iii. Part 6: Sir H. E. Roscoe and C. Schorlemmer (Macmillan).

PAMPHLETS.—*Guide to the Examinations in Chemistry and Answers to Questions*: W. J. Harrison (Blackie).—*Guide to the Examinations in Geology and Answers to Questions*: W. J. Harrison (Blackie).

SERIALS.—*The London and Middlesex Note-book*, vol. i. No. 4 (Stock).—*Bulletin de l'Académie Royale des Sciences de Belgique*, No. 12, tome 22 (Bruxelles).—*Quarterly Journal of the Geological Society*, vol. xlviii. Part 1, No. 189 (Longmans).—*Rendiconto dell'Accademia dell' Scienze Fisiche e Matematiche* (Sezione della Società Reale di Napoli), January-December 1891 (Napoli).

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